

Remarks

A. Pending Claims

Claims 1691-1743 are pending.

B. Previous Response to Office Action

Applicant hereby incorporates by reference the arguments set forth in the Response to Office Action filed May 11, 2007.

C. The Claims Are Not Obvious Over Eastlund et al. In View of Rose Pursuant To 35 U.S.C. §103(a)

Claims 1691-1743 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 4,716,960 to Eastlund et al. (hereinafter “Eastlund”) in view of European Patent Application 0130671 to Rose (hereinafter “Rose”). Applicant respectfully disagrees with these rejections.

If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

Teaching away from art is a *per se* demonstration of lack of obviousness. *In re Dow Chemical Co.*, 837 F.2d 469, 5 USPQ2d 1529 (Fed. Cir. 1988); *In re Fine*, 837, F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

Claim 1691 describes a combination of features including:

at least one electrical conductor comprising an electrically resistive ferromagnetic material, the electrical conductor being configured to provide an electrically resistive heat output during application of AC to the electrical conductor, and the electrical conductor being configured to provide a reduced amount of heat above or near a selected temperature, the selected temperature being within about 50 °C of the Curie temperature of the ferromagnetic material.

Claim 1710 describes a combination of features including:

at least one electrical conductor comprising an electrically resistive ferromagnetic material, the electrical conductor being configured to provide an electrically resistive heat output during application of AC to the electrical conductor, and the electrical conductor being configured to provide a reduced amount of heat above or near a selected temperature that is about 20% or less of the heat output at about 50 °C below the selected temperature, and wherein the selected temperature is at or about the Curie temperature of the ferromagnetic material.

Claim 1729 describes a combination of features including:

wherein one or more of the electrically resistive ferromagnetic sections are configured to provide a reduced amount of heat above or near a selected temperature, the selected temperature being within about 50 °C of the Curie temperature of the ferromagnetic material.

In the Office Action, the Examiner states: "Eastlund which has the heating output of 5000 to 13,600 watts has the capability of producing more than 73-85 degrees in Fahrenheit in order to produce the temperature of the sub-formation at 200-300 ft below at 73-85 degrees in Fahrenheit. The applied Rose reference also shows that it is known for a ferromagnetic heater to have the heating output capability of producing the Curie temperature up to 760 degree in Celsius."

Applicant submits that Eastlund appears to teach away from operating at higher temperatures (for example, at or near the Curie temperatures described by Rose). Eastlund states: "It is believed that the maximum current flows primarily along the inner wall and decreases radially outward from the inner wall of the tubing with very little current flowing along the outer wall of the tubing. For this reason, shorting between the tubing and casing does not significantly affect the heating of the tubing by the current flowing therethrough and of course heat transfer through the liquid medium from the sucker rod." (Eastlund, column 7, lines 23-31). Eastlund also states: "In a test utilizing the system of FIG. 6 the casing and tubing were in electrical contact and shorted at 575 feet and 2,050 feet. The wire extended down in the well to a depth of 800 feet where the wire was shorted to the tubing by a scratcher. Fifty feet of free wire was connected to a source of power delivering 2140 watts from a 120 volt source. Power was controlled by an S.C.R. power controller. After 12.5 hours temperature at 350 feet had increased

from 77.degree. F. to 89.degree. F. and at 750 feet had increased from 80.degree. F. to 90.degree. F. This test demonstrated that shorting between the tubing and casing does not substantially reduce the efficiency of the system of FIG. 6.” (Eastlund, column 9, lines 21-33).

If the Eastlund device were to operate at the Curie temperature, as taught by the Rose device, electrical current would flow through the entirety of the heater at the Curie temperature and significant current would flow along the outer wall of the tubing of the Eastlund device. Having significant electrical current flow on the tubing outer wall along with shorting between the tubing and the casing would significantly affect the heating of the tubing. Electrical current would flow between the tubing and casing due to the shorting if the heater would operate at or near the Curie temperature. Thus, Eastlund teaches away from having electrical current flowing through the entire heater, as occurs at the Curie temperatures described by Rose. Modifying the Eastlund device to operate at the Curie temperatures described by Rose would appear to make the Eastlund device unsatisfactory for its intended purpose as disclosed by the above-quoted requirements for the device.

In addition, Eastlund states: “An object of this invention is to electrically heat the tubing of a petroleum well by passing current through the tubing to **prevent formation of solids** such as paraffins.” (Eastlund, column 1, lines 47-50) (emphasis added). Modifying the Eastlund device to operate at or near the Curie temperatures described by Rose would appear to render the Eastlund device unsatisfactory for its intended purpose of preventing formation of solids. In fact, operating the Eastlund device at or near the Curie temperatures may **increase the formation of solids** by increasing the cracking of hydrocarbons (petroleum) inside the tubing, thus leading to coke (solid carbon) formation in the tubing. Thus, Eastlund appears to teach away from operating at or near the Curie temperatures as described by Rose.

For the above reasons, Applicant submits that there is no teaching or suggestion to make the modification proposed by the Office Action. Applicants respectfully requests withdrawal of the obviousness rejection of claims 1691, 1710, 1729, and the claims dependent thereon.

Applicant submits, in addition, that some of the claims dependent on claims 1691, 1710, and 1729 are separately patentable.

Claims 1692 and 1711 describe combinations of features including: “at least one

production well extending into the hydrocarbon containing layer and configured to produce at least some of the mobilized hydrocarbons from the hydrocarbon containing layer.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1692 and 1711, in combination with the other features of the claims.

Claims 1693 and 1712 describe combinations of features including: “wherein at least one electrical conductor transfers heat during use to hydrocarbons in the hydrocarbon containing layer to at least mobilize some hydrocarbons in the layer.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1693 and 1712, in combination with the other features of the claims.

Claims 1694 and 1713 describe combinations of features including: “wherein at least one electrical conductor transfers heat during use to hydrocarbons in the hydrocarbon containing layer to pyrolyze at least some hydrocarbons in the layer.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1694 and 1713, in combination with the other features of the claims.

Claims 1695 and 1714 describe combinations of features including: “wherein the heater well extends from the surface of the earth through an overburden of the formation into the hydrocarbon containing layer.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1695 and 1714, in combination with the other features of the claims.

Claims 1696 and 1715 describe combinations of features including: “wherein at least one of the ferromagnetic sections heats during use to a temperature of at least about 650 °C.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1696 and 1715, in combination with the other features of the claims.

Claims 1697 and 1716 describe combinations of features including: “wherein the AC supply is coupled to a supply of line current, and wherein the AC supply is configured to provide AC at about three times the frequency of the line current.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1697 and 1716, in combination with the other features of the claims.

Claims 1698 and 1717 describe combinations of features including: “wherein the AC supply is configured to provide AC with a frequency between about 140 Hz and about 200 Hz.”

The cited art does not appear to teach or suggest at least the above-quoted features of claims 1698 and 1717, in combination with the other features of the claims.

Claims 1699 and 1718 describe combinations of features including: “wherein AC supply is configured to provide AC with a frequency between about 400 Hz and about 550 Hz.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1699 and 1718, in combination with the other features of the claims.

Claims 1700 and 1719 describe combinations of features including: “wherein the ferromagnetic material comprises iron, nickel, chromium, cobalt, tungsten, or a mixture thereof.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1700 and 1719, in combination with the other features of the claims.

Claims 1701 and 1720 describe combinations of features including: “wherein a thickness of the ferromagnetic material is at least about $\frac{3}{4}$ of a skin depth of the AC at the Curie temperature of the ferromagnetic material.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1701 and 1720, in combination with the other features of the claims.

Claims 1702 and 1721 describe combinations of features including: “wherein the heat output below the selected temperature is greater than about 400 watts per meter of the electrical conductor.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1702 and 1721, in combination with the other features of the claims.

Claims 1703 and 1722 describe combinations of features including: “wherein at least a portion of at least one of the electrical conductors is longer than about 10 m.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1703 and 1722, in combination with the other features of the claims.

Claims 1704 and 1723 describe combinations of features including: “wherein the system is configured to sharply reduce the heat output at or near the selected temperature.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1704 and 1723, in combination with the other features of the claims.

Claims 1705 and 1724 describe combinations of features including: “wherein the system is configured such that the heat output of at least a portion of the system decreases at or near the selected temperature due to the Curie effect.” The cited art does not appear to teach or suggest at

least the above-quoted features of claims 1705 and 1724, in combination with the other features of the claims.

Claims 1706 and 1725 describe combinations of features including: “wherein the system is configured to apply AC of at least about 70 amps to at least one of the electrically resistive sections.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1706 and 1725, in combination with the other features of the claims.

Claims 1707 and 1726 describe combinations of features including: “wherein at least one of the electrical conductors comprises a turndown ratio of at least about 2 to 1.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1707 and 1726, in combination with the other features of the claims.

Claims 1708 and 1727 describe combinations of features including: “wherein the system is configured to withstand operating temperatures of about 250 °C or above.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1708 and 1727, in combination with the other features of the claims.

Claims 1709 and 1728 describe combinations of features including: “wherein the electrical conductor is configured to automatically provide the reduced amount of heat above or near the selected temperature.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1709 and 1728, in combination with the other features of the claims.

Claim 1730 describes a combination of features including: “producing at least some of the mobilized hydrocarbons from the layer through a production well extending into the hydrocarbon containing layer.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1730, in combination with the other features of the claim.

Claim 1731 describes a combination of features including: “wherein the transferred heat pyrolyzes at least some hydrocarbons in the hydrocarbon containing layer.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1731, in combination with the other features of the claim.

Claim 1732 describes a combination of features including: “producing at least some of the pyrolyzed hydrocarbons from the layer through a production well extending into the hydrocarbon containing layer.” The cited art does not appear to teach or suggest at least the

above-quoted features of claim 1732, in combination with the other features of the claim.

Claim 1733 describes a combination of features including: “wherein the heater well extends from the surface of the earth through an overburden of the formation into the hydrocarbon containing layer.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1733, in combination with the other features of the claim.

Claim 1734 describes a combination of features including: “wherein at least one of the ferromagnetic sections heats to a temperature of at least about 650 °C.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1734, in combination with the other features of the claim.

Claim 1735 describes a combination of features including: “providing an initial electrically resistive heat output when the electrical conductor providing the heat output is at least about 50 °C below the selected temperature, and automatically providing the reduced amount of heat above or near the selected temperature.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1735, in combination with the other features of the claim.

Claim 1736 describes a combination of features including: “providing the AC at about three times the frequency of line current from an AC supply.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1736, in combination with the other features of the claim.

Claim 1737 describes a combination of features including: “providing the AC at a frequency between about 140 Hz and about 200 Hz.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1737, in combination with the other features of the claim.

Claim 1738 describes a combination of features including: “providing the AC at a frequency between about 400 Hz and about 550 Hz.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1738, in combination with the other features of the claim.

Claim 1739 describes a combination of features including: “wherein a thickness of at least one of the ferromagnetic sections is at least about $\frac{1}{4}$ of a skin depth of the AC at the Curie temperature of the ferromagnetic material.” The cited art does not appear to teach or suggest at

least the above-quoted features of claim 1739, in combination with the other features of the claim.

Claim 1740 describes a combination of features including: “providing a reduced amount of heat above or near the selected temperature of less than about 400 watts per meter of length of the electrical conductor.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1740, in combination with the other features of the claim.

Claim 1741 describes a combination of features including: “controlling a skin depth in the electrical conductor by controlling a frequency of the AC applied to the electrical conductor.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1741, in combination with the other features of the claim.

Claim 1742 describes a combination of features including: “controlling the amount of current applied to the electrical conductors to control an amount of heat provided by at least one of the electrically resistive sections.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1742, in combination with the other features of the claim.

Claim 1743 describes a combination of features including: “applying current of at least about 70 amps to the electrical conductor.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1743, in combination with the other features of the claim.

D. Provisional Double Patenting Rejections

Claims 1691-1743 were provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1691-1747 of copending U.S. Pat. Appl. No. 10/693,820 and claims 1691-1753 of copending U.S. Pat. Appl. No. 10/693,840. Upon the present application being in condition for allowance but for the double patenting rejections, Applicant will provide arguments for the inappropriateness of the double patenting rejections and/or provide a terminal disclaimer.

E. Additional Comments

A Fee Authorization is attached to cover the fees due with the filing of the Request for Continued Examination. If an extension of time is required, Applicant hereby requests the appropriate extension of time. If any fees are required, please charge those fees to Meyertons, Hood, Kivlin, Kowert & Goetzel, P.C. Deposit Account Number 50-1505/5659-21000/EBM.

Respectfully submitted,



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